

HP StorageWorks U320e SCSI Host Bus Adapter

User guide



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About this guide

This guide provides information about:

- installing and connecting devices to the HP StorageWorks U320e SCSI Host Bus Adapter
- configuring the HP StorageWorks U320e SCSI Host Bus Adapter
- troubleshooting the HP StorageWorks U320e SCSI Host Bus Adapter

Intended audience

This guide is intended for the person who installs, administers, and troubleshoots servers and storage systems. HP assumes you are qualified in servicing computer equipment and trained in recognizing hazards in products with hazardous energy levels.

Document conventions and symbols

Table 1 Document conventions

Convention	Element
Blue text: Table 1	Cross-reference links and e-mail addresses
Blue, underlined text: http://www.hp.com	Website addresses
Bold text	<ul style="list-style-type: none">• Keys that are pressed• Text typed into a GUI element, such as a box• GUI elements that are clicked or selected, such as menu and list items, buttons, tabs, and check boxes
<i>Italic</i> text	Text emphasis
Monospace text	<ul style="list-style-type: none">• File and directory names• System output• Code• Commands, their arguments, and argument values
<i>Monospace, italic</i> text	<ul style="list-style-type: none">• Code variables• Command variables
Monospace, bold text	Emphasized monospace text

WARNING!

Indicates that failure to follow directions could result in bodily harm or death.

CAUTION:

Indicates that failure to follow directions could result in damage to equipment or data.

IMPORTANT:

Provides clarifying information or specific instructions.



NOTE:

Provides additional information.



TIP:

Provides helpful hints and shortcuts.

HP technical support

For worldwide technical support information, see the HP support website:

<http://www.hp.com/support>

Before contacting HP, collect the following information:

- Product model names and numbers
- Technical support registration number (if applicable)
- Product serial numbers
- Error messages
- Operating system type and revision level
- Detailed questions

Customer self repair

This product was designed for customer self repair. Under this product's warranty, if a part needs replacing, HP ships the part directly to you so that you can install it at your convenience.

For more information about CSR, contact your local service provider. For North America, see the CSR website:

<http://www.hp.com/go/selfrepair>

Product warranties

For information about HP StorageWorks product warranties, see the warranty information website:

<http://www.hp.com/go/storagewarranty>

Subscription service

HP recommends that you register your product at the Subscriber's Choice for Business website:

<http://www.hp.com/go/e-updates>

After registering, you will receive e-mail notification of product enhancements, new driver versions, firmware updates, and other product resources.

HP websites

For additional information, see the following HP websites:

- <http://www.hp.com>
- <http://www.hp.com/go/storage>
- http://www.hp.com/service_locator
- <http://www.hp.com/support/manuals>

- <http://www.hp.com/support/downloads>

Documentation feedback

HP welcomes your feedback.

To make comments and suggestions about product documentation, please send a message to storagedocs.feedback@hp.com. All submissions become the property of HP.

1 Features

The HP StorageWorks U320e SCSI Host Bus Adapter represents the seventh generation of parallel SCSI technology, an I/O interface that is committed to increased performance while maintaining backward compatibility and legacy support. The HP StorageWorks U320e SCSI Host Bus Adapter is a dual channel Ultra 320 SCSI PCIe host adapter.

Summary of specifications

Feature	Details
Card type	Low-profile PCI express
Slot connector	PCIe x4
Devices supported	HP StorageWorks MSL Tape Libraries, 1/8 G2 Tape Autoloader
Device modes supported	LVD and SE
Number of peripherals that can be connected	15 per channel (see Table 2 , page 14)
Number of SCSI busses	2
SCSI modes supported	Ultra320, Ultra160, Ultra2
SCSI data transfer rate	Up to 320 MB/s per channel
IUN support	0–7 LUNs by default

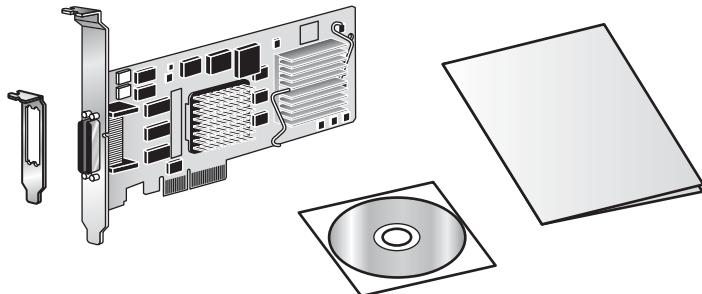
For more information about the adapter features, specifications, and compatibility, see the "[Technical specifications](#)" on page 39.

2 Installation

△ **CAUTION:**

Back up your system data before changing or installing hardware.

Follow the steps in this chapter to install the host bus adapter.



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Figure 1 Kit contents

The HP StorageWorks U320e SCSI Host Bus Adapter package includes:

- Host bus adapter
- Half-height bracket
- CD containing documentation, drivers, and utilities
- *Getting started* poster and warranty card

System requirements

To install and use the HP StorageWorks U320e SCSI Host Bus Adapter you will need:

- A computer with an available x4 PCI Express expansion slot or larger, such as x8 or x16.
- The HP StorageWorks U320e SCSI Host Bus Adapter package.

△ **CAUTION:**

The host bus adapter contains components that are sensitive to electrostatic discharge (ESD). The host bus adapter can be damaged by electrostatic discharge. Keep parts in electrostatic containers until needed. Ensure that you are properly grounded when touching static-sensitive components.

Installation overview

⚠ **WARNING!**

To reduce the risk of personal injury or damage to the equipment, consult the safety information and user documentation provided with the server before attempting the installation.

Many servers are capable of providing energy levels that are considered hazardous and are intended to be serviced only by qualified personnel who have been trained to deal with these hazards. Do not remove enclosures or attempt to bypass any interlocks that may be provided for the purpose of removing these hazardous conditions.

 WARNING!

When installing the adapter in a server in a rack, to reduce the risk of personal injury or damage to the equipment, adequately stabilize the rack before extending a component outside the rack. Extend only one component at a time. A rack may become unstable if more than one component is extended.

The installation procedure involves the following steps:

1. Planning the installation (see page 14)
2. Preparing the server (see page 16)
3. Installing the adapter hardware (see page 17)
4. Connecting the devices (see page 17)
5. Validating the SCSI bus (see page 19)

Planning the installation

To minimize system downtime, plan the installation before powering off the server:

1. Plan the SCSI busses.

The adapter has two channels. When planning your SCSI busses, keep the following in mind:

- Total bus cable length varies by the type of attached devices. See [Table 2](#) for details on maximum cable length. See the documentation for your devices to find the cable length inside the device.

Table 2 SCSI capabilities

SCSI standard	Bus speed MB/sec. max.	Bus width bits	Max. bus length in meters		Max. device support ¹
			Single-ended	LVD	
SCSI-1	5	8	6	—	8
Fast SCSI	10	8	3	—	8
Fast Wide SCSI	20	16	3	—	16
Wide Ultra/WIDE SCSI	40	16	1.5	—	8
Wide Ultra/WIDE SCSI	40	16	3	—	4
Ultra2 SCSI	80	16	—	12	16
Ultra160 SCSI	160	16	—	12	16
Ultra320 SCSI	320	16	—	12	16

¹Including the HBA.

- If you combine wide 16-bit and narrow 8-bit devices on the same SCSI bus, connect the wide devices first (closest to the connector).
- Refer to the documentation for your SCSI devices to determine whether they are Ultra2, Ultra160, or Ultra320 SCSI.

 NOTE:

HP recommends not mixing Single-Ended and LVD devices on the same bus because the host adapter card will operate with Single-Ended signaling at UltraSCSI speeds, which will significantly decrease the speed of high-performance tape drives.

2. Plan the SCSI device termination.

The last device in the bus — that farthest from the adapter — must be properly terminated for each SCSI bus. When planning device termination, keep the following in mind:

- Use an LVD terminator if you are only using LVD devices.

Although you can use a Single-Ended terminator, all devices will be limited to Ultra SCSI speeds and cable lengths. Single-Ended devices require a Single-Ended terminator. If you use an LVD terminator with Single-Ended devices, the system may hang or devices may not be seen on the SCSI bus. Some termination manufacturers provide automatically sensing terminators.

- LVD Ultra2 and Ultra160 SCSI devices cannot supply their own termination.
- Wide (16-bit) and narrow (8-bit) devices can be connected together on the same connector of the host adapter card, but wide devices must be attached first, followed by narrow devices.

To terminate the SCSI bus, the cable or adapter used to convert from a wide (68-pin) connector to a narrow (50-pin) connector provides partial termination, allowing the upper 8-bits (or byte) of the wide SCSI bus to be properly terminated. A narrow terminator should be used on the last narrow device to terminate the rest of the SCSI bus. A SCSI bus without partial termination between the wide and narrow devices may at first appear to work correctly, but occasional I/O errors occur without proper termination.

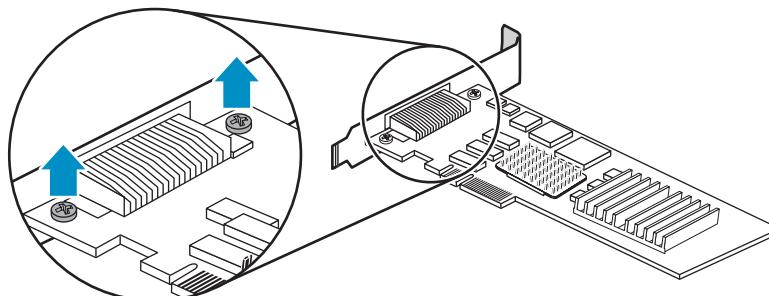
- Termination power: Host adapters supply termination power to the bus at all times and many SCSI devices are also able to supply termination power. SCSI signal quality, particularly with long or marginal quality cables, may be improved if the device supplies the termination power. See your device documentation for information on your device's ability to supply termination power.

3. Review system documentation to select an appropriate slot to install the adapter.

The combined power consumption of the expansion slots must not exceed the limits for your system. If you have more than one expansion card installed, ensure power consumption is within the limits outlined for your system.

4. If the selected installation slot is low profile, replace the mounting bracket on the adapter.

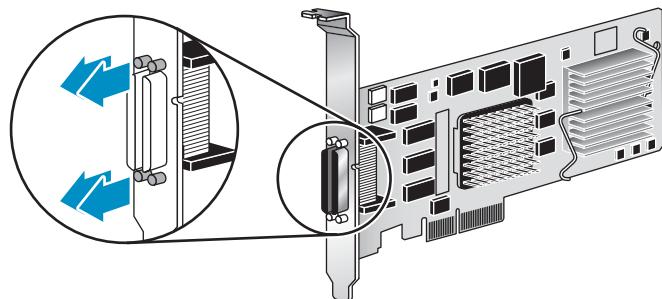
- Remove the two screws on top of the board that secure the bracket to the board, as shown in [Figure 2](#).



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Figure 2 Removing the bracket screws

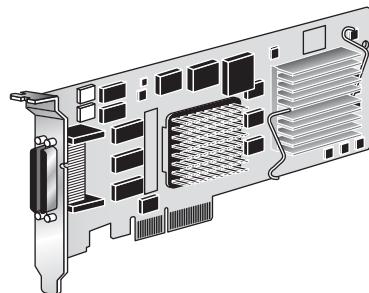
b. Use a small, flat screwdriver to remove the four stand-offs on the external connectors, as shown in [Figure 3](#).



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Figure 3 Removing the stand-offs

c. Remove the bracket and replace it with the low-profile bracket. Verify that the new bracket is oriented correctly, as shown in [Figure 4](#).



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Figure 4 Card with low-profile bracket

d. Replace the four stand-offs to secure the bracket to the board.
e. Attach the two screws to the high-profile bracket in case you need the larger bracket to install the adapter in another server.

Preparing the server

To prepare the server for the new adapter:

- 1.** Back up all data.
- 2.** Perform a normal system shutdown.
- 3.** Power down the server.
- 4.** Power down all peripheral devices that are connected to the server.
- 5.** Unplug the server's AC power cords from the power outlet and then from the server.
- 6.** Disconnect all peripheral devices from the server.

Installing the adapter hardware

⚠ CAUTION:

Electrostatic discharge can damage electronic components. Be sure you are properly grounded before beginning this procedure. For more information, see "Appendix: Electrostatic discharge" on page 53.

To install the host bus adapter hardware:

1. Open the server case.

⚠ WARNING!

To reduce the risk of personal injury from hot surfaces, allow the drives and the internal system components to cool before touching them.

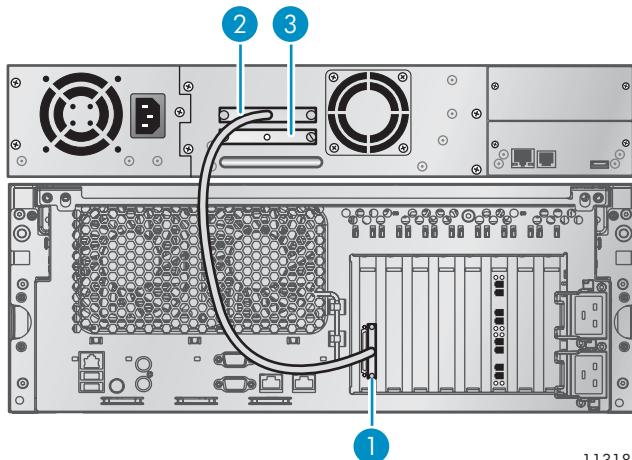
2. Install the adapter in the selected PCIe expansion slot. Consult your computer's documentation if you have questions about how to install an expansion card in your system.
3. Close the computer case.

Connecting the devices

To connect the devices:

1. Connect SCSI devices with SCSI cables.

Insert a SCSI cable into a connector on the HP U320e SCSI Host Bus Adapter, as shown in [Figure 5](#). Verify that the connector is properly seated and tighten the screws on the connector. Connect the other end of the cable to the first device in the bus. Connect the rest of the devices to each other, if applicable. Repeat to connect the devices to the second bus, if applicable.



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Figure 5 Connecting the SCSI cable and terminator

1. SCSI cable connection on the adapter
2. SCSI cable connection on the device
3. SCSI terminator

2. Connect a terminator to each device at the end of a SCSI bus.
3. Reconnect the power cables.

4. Power up the server and peripherals.

The HP U320e SCSI Host Bus Adapter comes pre-configured to operate properly in a variety of common setups. However, some systems may benefit by tuning the adapter for a specific application. See [Chapter 4](#) on page 25 for information on changing host adapter settings.

Installing drivers

After installing the HP StorageWorks U320e SCSI Host Bus Adapter, you must configure your system to recognize and use it by installing drivers for your operating system.

 **NOTE:**

If you already have one or more HP StorageWorks U320e SCSI Host Bus Adapters installed in the server and you are installing additional adapters, you do not need to install drivers unless you are updating a previously installed driver.

Windows

To install the Windows driver from the product CD:

1. Load the product CD into the computer. The CD will display an HTML page.
2. Click the arrow next to **Drivers** in the **Extras** section.
3. Double-click the driver package for your operating system to extract the files.
4. Navigate to the location where you extracted the files.
5. Double-click `setup.exe`.
6. Click **Install**.

To install the Windows driver from the HP website:

1. Download the driver package for your operating system from <http://www.hp.com/support/u320e>. The driver package is a self-extracting archive.
2. In Windows Explorer, navigate to the location of the downloaded driver package. Double-click the driver package to extract the files.
3. Navigate to the location where you extracted the files.
4. Double-click `setup.exe`.
5. Click **Install**.

Linux

To install the Linux driver package from the product CD:

1. Load the product CD into the computer. The CD will display an HTML page.
2. Click the arrow next to **Drivers** in the **Extras** section.
3. Copy the Linux driver package to the file system.
4. Unzip the driver package and view the `readme.txt` file for release notes and installation instructions.

HP provides patches for the AH627A driver in the Linux 2.4 and 2.6 kernels to allow the driver to operate on the HP StorageWorks U320e SCSI Host Bus Adapter.

To install the Linux driver package from the HP website:

1. Download the Linux driver package from <http://www.hp.com/support/u320e>.

2. Unzip the driver package and view the `readme.txt` file for release notes and installation instructions.

HP provides patches for the AH627A driver in the Linux 2.4 and 2.6 kernels to allow the driver to operate on the HP StorageWorks U320e SCSI Host Bus Adapter.

Updating firmware

The HP StorageWorks U320e SCSI Host Bus Adapter ships with the latest firmware installed. If you are installing a new adapter, you do not need to update the firmware. If you are upgrading a previously installed driver, update the adapter firmware to ensure proper operation.

Visit <http://www.hp.com/support/u320e> for the latest drivers and firmware.

To update the firmware, also called flash, using the ATTO Configuration tool:

1. Install the Configuration Tool on your system. (See [Installing the ATTO Configuration Tool](#), page 25.)
2. Download the flash bundle from <http://www.hp.com/support/u320e> and extract the firmware files to your desktop.
3. Launch the Configuration Tool.
4. In the **Device** window, select the **ATTO Express PCI UL5D** adapter.
5. In the **Flash** window, click **Browse** to find the flash bundle that you previously downloaded to your desktop.
6. Click **Update** to update the flash ROM in the adapter.
7. Reboot your system for the flash changes to take effect.

Validating the SCSI bus (Windows only)

On Windows, install and run the SCSI Domain Validation utility to verify the connections in the SCSI busses. See "[SCSI Domain Validation utility \(Windows only\)](#)" on page 21 for more information.

3 SCSI Domain Validation utility (Windows only)

The SCSI Domain Validation utility tests the physical connection between host adapter and devices to ensure that the desired data transfer speeds can be achieved. Domain Validation eliminates the guesswork of determining transfer rates and is a handy tool for configuring SCSI busses.

As SCSI performance has increased over the past several years, it has become more important to verify that the connections between the host adapter and storage devices, such as cables, connectors and target, are capable of handling high-speed data transfers. Previously, users had to manually decrease transfer rates by trial and error until data was transferred successfully. Domain Validation (DV) eliminates guesswork by verifying the connection. The ATTO SCSIDV utility performs Domain Validation on your storage connection. The three DV tests can be selected in the SCSIDV Main Screen.

- Basic Integrity Test performs a simple integrity check to determine the fastest valid mode of operation between the initiator and target, detecting most physical configuration problems such as path width errors, expander errors, gross cable errors, incorrect termination, or a damaged transceiver.
- Enhanced Integrity Test performs a more advanced integrity check. A data pattern intended to stress the physical domain is written to and then read from memory on the device and compared with the original data pattern. If data compare errors are detected, fallback is attempted until a valid mode of operation is found. Problems detected by the Enhanced Integrity Test include cables with incorrect impedance, bad SCSI device spacing, poor termination, marginal transceivers, excessive crosstalk, and excessive system noise.
- Margining Test varies driver signal strength by +/- 20% and verifies the integrity of the subsystem using the same methods as the Enhanced Integrity Test. Failure indicates that the subsystem is close to failure because inferior components are significantly degrading SCSI bus signals and thus lowering the signal margins. This can result in sudden subsystem failure or intermittent integrity errors.

Installing the Domain Validation utility

To install the Domain Validation utility from the product CD:

1. Load the product CD into the computer. The CD will display an HTML page.
2. Click the arrow next to **Utilities** in the **Extras** section.
3. Double-click `win_app_hbutil_330hp.exe` to extract the files.
4. Navigate to the location where you extracted the files.
5. Double-click `Setup.msi`.
6. Follow the directions in the installer to finish the installation.

To install the Domain Validation utility from the HP website:

1. Download the Domain Validation utility from <http://www.hp.com/support/u320e>. The package is a self-extracting archive.
2. In Windows Explorer, navigate to the location of the downloaded package. Double-click the package to extract the files.
3. Navigate to the location where you extracted the files.
4. Double-click `Setup.msi`.

- Follow the directions in the installer to finish the installation.

Running the Domain Validation utility

To run the ATTO SCSI Domain Validation tool:

- Launch the tool.
- Select the adapter **Channel** of the SCSI bus, as shown in [Figure 6](#).

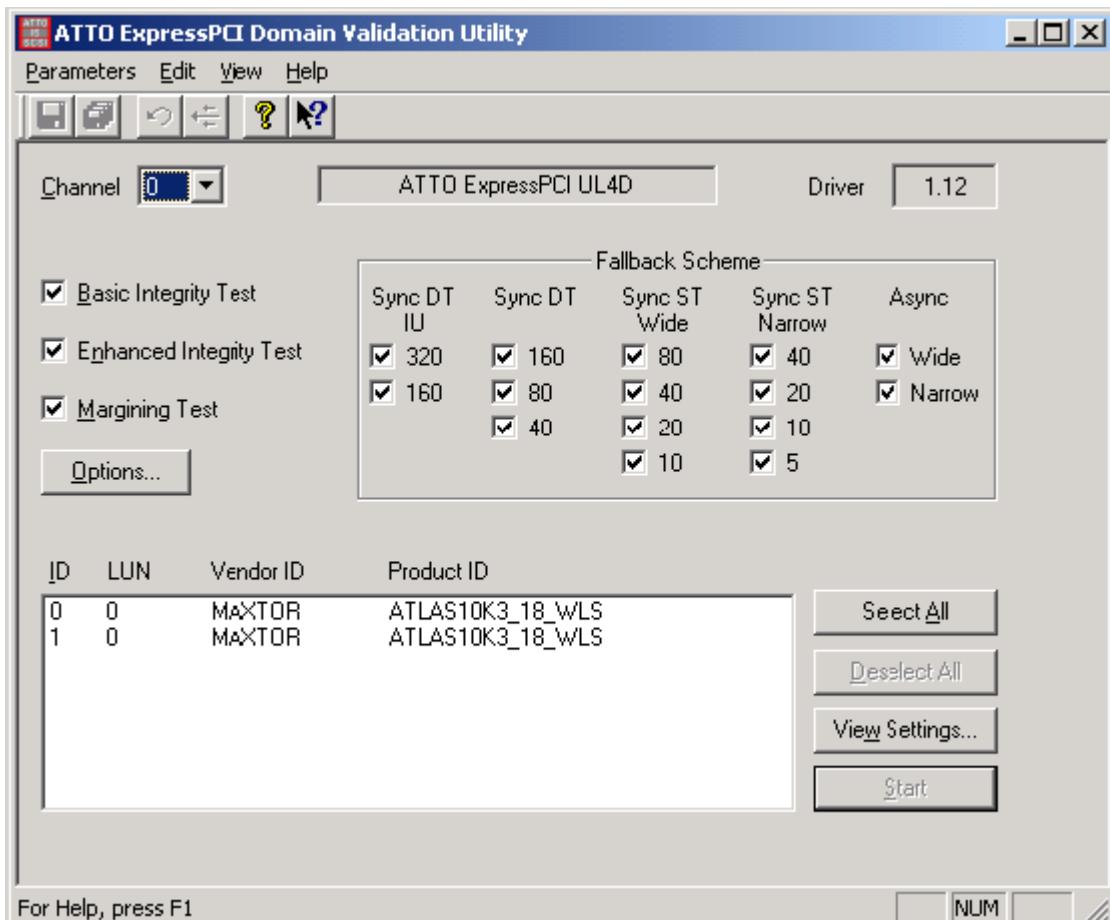


Figure 6 Domain Validation Utility

- Select the tests to be run.
- In **Fallback Scheme**, select the negotiation parameters. The SDV test starts with the highest values and if a problem is detected, tests with the next lower set of values.
- Select the target devices to be tested. The test is performed between the initiator and each target device selected.
- Press **Start** to start the test.

When the test is complete, a message panel displays. The panel shows the negotiated SCSI parameters for each device. The left side of the screen shows the negotiated value after the test runs and the right side shows the value before the test being run.

The **Changed?** column indicates whether the negotiated value changed as a result of the SCSI Domain Validation tests. If the value did change, the connection between the initiator and the target device may not have been optimized.

The SCSI Domain Validation help text provides useful information about setting up the tests. Review the help text for a more detailed explanation of the tool.

4 Configuration tool

The HP StorageWorks U320e SCSI Host Bus Adapter ships with the latest firmware installed and configuration set to work in most installations. Use the ATTO Configuration Tool to see information about installed adapters, drivers and devices, and change NVRAM settings on the adapter.

This program executes under:

- Windows® XP/2000/Server 2003
- Linux® 2.4 and 2.6 kernels

The ATTO Configuration Tool displays:

- The names of HP StorageWorks U320e SCSI Host Bus Adapters and other ATTO adapters installed in the system.
- Information about the drivers controlling the adapters, including version information for both the currently executing driver and the flash image.
- Information about the devices attached to the HP StorageWorks U320e SCSI Host Bus Adapter and ATTO adapters

 **NOTE:**

The factory settings on the HP StorageWorks U320e SCSI Host Bus Adapter should provide excellent performance for a wide range of applications. However, some applications may benefit from modification of the adapter NVRAM settings that tune the adapter for a specific performance range.

Installing the ATTO Configuration Tool

To install the ATTO Configuration Tool from the product CD:

 **NOTE:**

The version on the product CD may be older than the version on the website. Please check the HP website for newer versions.

1. Load the product CD into the computer. The CD will display an HTML page.
2. Click the arrow next to **Utilities** in the **Extras** section.
3. On Windows, double-click `win_app_configtool_308.exe`. Follow the instructions in the installer to finish the installation.
4. On Linux, double-click `lnx_app_configtool_308.bin`. If the executable bit is not set, run `sh </path/to/bin>`.

To install the ATTO Configuration Tool from the HP website:

1. Download the ATTO Configuration Tool from <http://www.hp.com/support/u320e> to your filesystem.
2. Navigate to the downloaded file.
3. Double-click the downloaded file to start the installer. Follow the instructions in the installer to finish the installation.

Using the Configuration Tool

NOTE:

The HP StorageWorks U320e SCSI Host Bus Adapter is designed to operate properly using factory settings. Entering invalid or incorrect settings when using an NVRAM configuration utility, such as the ATTO Configuration Tool, may cause your host adapter to function incorrectly.

CAUTION:

Back up system data before installing or changing hardware configurations.

To start the Configuration Tool:

1. Locate the application icon in the folder you created during installation.
2. Double-click the icon to start the application.

The main screen has three windows: **Device Listing**, **Configuration Options**, and **Status**.

Navigating the ATTO Configuration Tool

The left side of the **Device Listing** window lists all devices currently connected to the system.

- Expand the device tree by clicking the + to reveal additional detail on connected devices.
- Collapse the branch by clicking the -.

Information and options for a device highlighted in the device listing are presented in the **Configuration Options** window in the right window pane.

The currently selected device determines the tabs and panels shown in the **Device Listing**. The [Table 3](#) specifies the tabs that display for each device type.

Table 3 Tabs displayed by device type

Tree Node	Tabs displayed
Adapter	Basic Info, Flash, Advanced
Channel	NVRAM, PCI info
SCSI Devices	Basic Info
Local Host	Basic Info

The following tabs display in the **Configuration Options** window when you select a specific adapter in the **Device Listing** window:

- The **Basic Info** tab provides basic information about the device currently highlighted in the device listing; no changes are possible from this screen or information about the host when the Local Host is highlighted.
- The **Flash** tab provides information about the current revision of the flash firmware loaded on the highlighted host adapter.

Click the **Browse** button at the bottom of the tab to search for new flash files on your system. Flash files have filenames of the form FlashBundle_2004_02_20.21P.

- The **Advanced** tab is not supported for the HP StorageWorks U320e SCSI Host Bus Adapter and will display a message.

When you select a specific channel under an HP StorageWorks U320e SCSI Host Bus Adapter or ATTO host adapter in the Device Listing, the NVRAM panel displays the NVRAM parameters applicable

to the adapter and channel selected. See "NVRAM settings" on page 27 for information about the NVRAM settings.

PCI information is displayed in the **PCI Info** tab.

The current status of the **Configuration Tool** is represented in the **Status** window at the bottom of the display screen.

The **About** panel, selected from the **About** menu item in the **Help** tab, is an informational screen only. The panel displays a list of components installed for the ATTO Configuration Tool and the tool's version number.

NVRAM settings

NOTE:

The HP StorageWorks U320e SCSI Host Bus Adapter is designed to operate properly using factory settings. Entering invalid or incorrect settings when using an NVRAM configuration utility, such as the ATTO Configuration Tool, may cause your host adapter to function incorrectly.

CAUTION:

Back up system data before installing or changing hardware configurations.

Use caution when making changes to NVRAM settings and only make changes to those you are familiar with. Once you have made the desired changes, click one of the following buttons:

- **Commit:** activates the changes which take effect after rebooting your system.
- **Defaults:** restores the adapter to factory default settings. The **Commit** button must be checked to save any changes.
- **Restore:** reverts to the NVRAM settings saved the last time the **Commit** button was used. Clicking **Commit** is not necessary.

The upper part of the NVRAM Config panel contains common NVRAM settings that pertain to the entire channel. The lower part contains settings that can be set for each SCSI ID on the channel.

Controller ID	Choices: 0–15 Default: 7 The adapter is normally set to SCSI ID 7 because ID 7 has the highest priority on the bus. The setting should remain at ID 7 unless you are instructed to change it by an HP Support representative.
Termination	Choices: Auto, High Default: Auto Set to Automatic unless there is a narrow SCSI cable connected to the external connector.
Selection Timeout (ms)	Choices: 1 ms — 1 sec Default: 250 ms Specifies the amount of time a device has to respond to being selected. The time value can be lowered to speed up the boot process. If the value is lower than the recommended 250 ms, some devices may not have enough time to respond.

Fallback Sync Rate (MB/s)	<p>Choices: 40/20, 20/10, and 10/5</p> <p>Default: 40/20</p> <p>Specifies the maximum synchronous transfer rate to be negotiated when the adapter detects a Single-Ended SCSI bus. The bus is Single-Ended when Ultra SCSI devices are connected to the bus.</p>
Bus Reset Delay (sec)	<p>Read only; no choices</p> <p>Default: 3</p> <p>The time delay between the reset of the SCSI bus and the scanning of the SCSI bus. This is a read-only parameter.</p>
Quick Arbitrate & Select	<p>Choices: Disabled, Enabled</p> <p>Default: Enabled</p> <p>If enabled, improves performance by reducing the time required to gain control of the SCSI bus. QAS can only be enabled if all target settings are set to <i>Sync DT-IU</i> and all devices on the bus support QAS.</p>
LUNs	<p>Choices: Disable ID, 0, 0–7, 0–63</p> <p>Default: 0–7</p> <p>Specifies the number of LUNs that the driver addresses when scanning for devices, determined as follows:</p> <ul style="list-style-type: none"> • Disable ID: Target ID is bypassed and not scanned • 0: Scan LUN 0 for this target ID • 0–7: Scan LUNs 0 to 7 for this target ID • 0–63: Scan LUNs 0 to 63 for this target ID
Allow Disconnect	<p>Choices: Enabled, Disabled</p> <p>Default: Enabled</p> <p>Specifies whether a device is allowed to disconnect from the SCSI bus during SCSI command processing. The device determines when it disconnects. This setting does not force the device to disconnect.</p>
Tagged Command Queuing	<p>Choices: Enabled, Disabled</p> <p>Default: Enabled</p> <p>Specifies the driver if SCSI commands can use the Tag Command feature to send multiple commands to a device.</p>
Sync Offset	<p>Choices: 0–127</p> <p>Default: 127</p> <p>The defaults offer the best performance possible. The value should not be changed unless instructed by an HP Support representative.</p>
Sync Enabled for this ID	<p>Choices: Enabled, Disabled</p> <p>Default: Enabled</p> <p>Specifies whether the selected target transfers data as synchronous transfer rates or at the asynchronous rate. The maximum synchronous rate to negotiate is specified in the Sync Rate parameter.</p>

Sync Rate (MB/s) Choices: Sync DT IU (320, 160), Sync DT (160, 80, 40), Sync ST WIDE (80, 40, 20, 10), Sync ST Narrow (40, 20, 10, 5)

Default: Sync DT IU 320.

If synchronous transfers are enabled, the sync rate specifies the maximum rate at which host bus adapter negotiates with the selected target ID. Set the rate to the maximum value supported by the host adapter. If excessive SCSI errors occur, you have long cables, or there are many devices on the bus, you might want to reduce the *Sync Rate* value. Slowing the transfer rate may increase the reliability of the SCSI bus.

Wide Transfers

Choices: Disabled, Enabled

Default: Enabled

Specifies whether the initiator negotiates wide data transfers. If the parameter is disabled, narrow data transfers are negotiated. *Wide Transfers* is automatically set to Enabled when the *Sync Rate* specifies a DT rate. The DT sync rates must have wide data transfers.

5 Troubleshooting

This chapter describes troubleshooting techniques that can be used to identify and resolve issues associated with the HP StorageWorks U320e SCSI Host Bus Adapter. Some of these techniques may seem simplistic or overly obvious, but these are the ones that are commonly overlooked and can take several hours of frustration to find. It is important to only try one technique at a time. While changing multiple variables may seem to be a time saver, it usually complicates the troubleshooting process.

Investigating the adapter installation

To investigate problems that could be caused by the installation of the adapter:

1. The host adapter may be improperly seated. Power down the computer and reseat the host adapter.
2. Try putting the host adapter in a different PCI slot.

Investigating the SCSI cables and devices

To investigate problems that could be caused by the SCSI cables or devices:

1. Verify that all of the SCSI devices in the bus are powered on.
2. On Windows, run the SCSI Domain Validation utility. See "[SCSI Domain Validation utility \(Windows only\)](#)" on page 21.
3. Check the SCSI devices to make sure that they are all set to different SCSI IDs. Each device on a SCSI bus must use a unique ID, including the host adapter. Devices on bus 1 can have the same IDs as those on bus 2. By default, the host adapter uses SCSI ID 7, so devices should use IDs 0 through 6 or 8 through 15.
4. Check cable integrity. Check the cables for solid connections. Make sure they are screwed down. Inspect cable ends for bent pins. Ultra320 SCSI requires high quality cables that are specifically rated for the Ultra320 transmission speeds.
5. Boot into Windows and use the ATTO Configuration Tool to verify that the host adapter has its termination set properly. Instructions to do this can be found in the ATTO Configuration Tool help files.
6. Verify that the external terminator is the same SCSI type as the devices (certified for Ultra320 SCSI or lower) and does not have damaged pins.
7. Try attaching the SCSI devices one at a time with different cables, adding drives and cables until the problem occurs. This will help pinpoint the device or cable causing the problem.
8. Watch the LED indicators on the SCSI devices before, during, and after startup. Drive lights should also flash at startup as the SCSI bus is scanned. This may give a clue as to the root cause of the issue.

Windows installation troubleshooting

When working properly, the ATTO Technology Banner should appear shortly after booting the computer, as shown in [Figure 7](#).

```
*****
*      ATTO Express PCI™ Version 2.20      *
* Copyright © 2006   ATTO Technology, Inc.    *
*****  
*** Press [Ctrl] [Z] for Setup Utility ***  
Channel 0 EPCI UL5D I/O Addr 1000 Controlled by ExpressPCI  
Channel 1 EPCI UL5D I/O Addr 1400 Controlled by ExpressPCI
```

Figure 7 ATTO Technology Banner

The adapter will be listed as ATTO ExpressPCI UL5D SCSI Adapter in the Windows Device Manager, as shown in [Figure 8](#).

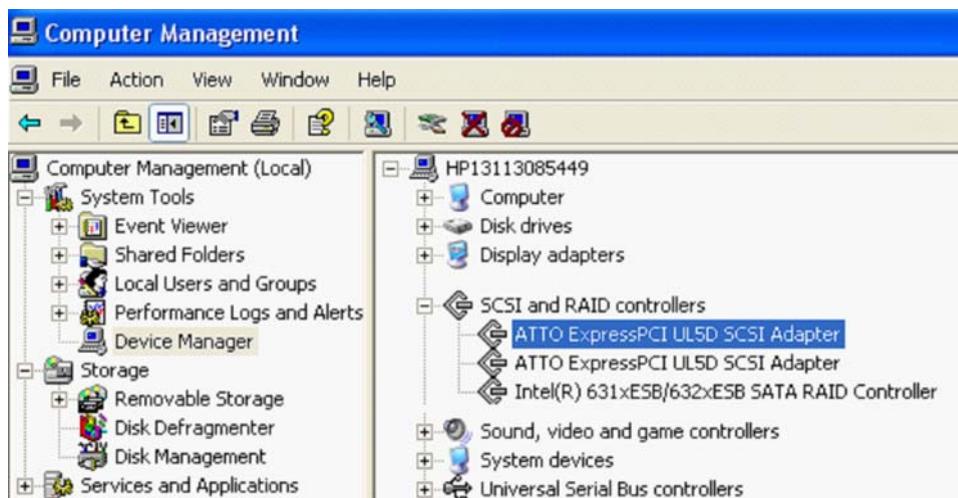


Figure 8 Adapter in Windows Device Manager

Table 4 Windows installation troubleshooting table

Symptoms	Troubleshooting steps
The computer will not boot past its Power On Self Test when the host adapter is installed	<ul style="list-style-type: none">Check the adapter installation (see Investigating the adapter installation, page 31).Disconnect any SCSI devices from the host adapter and reboot the computer. If this resolves the issue, check the SCSI cables and devices (see Investigating the SCSI cables and devices, page 31).If the computer still does not boot, try installing the host adapter in a different computer. If the host adapter works in the new computer, report this as a possible interoperability issue between the host adapter and the computer. If the problem follows the host adapter, replace it with a new adapter.Verify that the latest version of the computer BIOS is installed. Use caution when updating the computer's BIOS. A mistake could leave the system in an unusable state.

Symptoms	Troubleshooting steps
The host adapter is installed in the computer but it does not appear during the system BIOS scan.	<ul style="list-style-type: none"> • Check the adapter installation (see Investigating the adapter installation, page 31). • Verify that the latest version of the computer BIOS is installed. Use caution when updating the computer's BIOS. A mistake could leave the system in an unusable state. • Remove any non-vital PCI cards from the system to determine if there is a PCI bus conflict. • Disconnect any SCSI devices from the host adapter and reboot the computer. If this resolves the issue, check the SCSI cables and devices (see Investigating the SCSI cables and devices, page 31). • If the computer still does not boot, try installing the host adapter in a different computer. If the host adapter works in the new computer, try updating the flash on the host adapter as described in "Updating firmware" on page 19. Then try it again in the original computer. <ul style="list-style-type: none"> • If it still fails, report this as a possible interoperability issue between the host adapter and the computer. • If the problem follows the host adapter, replace it with a new adapter.
The computer freezes when the ATTO banner is displayed during the system BIOS scan	<p>Disconnect all devices from the adapter and reboot the system.</p> <p>If the system still freezes after disconnecting the SCSI devices:</p> <ul style="list-style-type: none"> • Remove any non-vital PCI cards from the system to determine if there is a PCI bus conflict. • Remove the SCSI host adapter and test it in a different computer (not the same model). If the card works properly, enter the ATTO ExpressPCI Utility during the system BIOS scan by hitting Ctrl-Z when prompted. Enter the host adapter configuration menu and disable the BIOS. There may be a BIOS conflict between the ATTO host adapter and the original computer. Place the host adapter back into the original machine and reboot. <ul style="list-style-type: none"> • If this resolves the issue, report this as a BIOS conflict. Note that you can continue to operate. Disabling the BIOS will only prevent the computer from booting from an external drive connected to the host adapter. • If the computer still hangs, replace the host adapter with a new one. <p>If the system no longer freezes after disconnecting the SCSI devices, investigate the SCSI cables and devices (see Investigating the SCSI cables and devices, page 31).</p>
The system's BIOS scan recognizes the host adapter, but it does not detect any of the connected SCSI devices.	<p>The ATTO Technology banner should appear shortly after rebooting the computer, as shown in Figure 7 on page 32. If the host adapter's BIOS is set to <i>Enabled</i> or <i>Scan only</i>, the connected devices, SCSI ID, and negotiated transfer rate for each of the SCSI busses will also be displayed.</p> <ul style="list-style-type: none"> • The SCSI host adapter BIOS may have been disabled (factory default is BIOS Enabled). Set it back to Enabled (if you need to boot from an external device connected to the host adapter) or Scan Only. • Investigate the SCSI cables and devices (see Investigating the SCSI cables and devices, page 31). • Try installing the host adapter in a different PCI slot. • Try updating the firmware on the host adapter as described in "Updating firmware" on page 19. • If all else fails, replace the SCSI host adapter.
The computer's BIOS scan recognizes the host adapter, but only detects connected SCSI devices on one of the busses. The other bus reports no devices.	<ul style="list-style-type: none"> • Swap the devices and cables from the SCSI bus that appears to be working with the one having issues. If the issue follows the bus, replace the SCSI host adapter. If the issue follows the attached SCSI devices, investigate the SCSI cables and devices (see Investigating the SCSI cables and devices, page 31).

Symptoms	Troubleshooting steps
The host adapter is detected during the system's BIOS scan but it is not detected by the operating system.	<p>When working properly, the host adapter will be listed in the Windows Device Manager, as shown in Figure 8 on page 32.</p> <ul style="list-style-type: none"> The driver may not be properly installed. See "Installing Windows drivers" on page 18 for instructions on installing the operating system driver. The firmware and driver may not be at compatible revision levels. The drivers are updated more frequently than the firmware, therefore the revision levels are seldom the same. The latest driver might also require a firmware update. See http://www.hp.com/support/u320e to verify that the system has the latest firmware and driver version. The firmware version can be viewed when the host adapter is detected during the computer's BIOS scan. The driver version can be verified from within the Device Manager.
The host adapter is detected by the operating system, it detects <i>some</i> of the connected devices on both SCSI busses, but does not detect <i>all</i> of the connected devices.	Check the SCSI cables and devices (see Investigating the SCSI cables and devices , page 31).
Errors are reported while trying to flash new firmware onto the SCSI host adapter.	<ul style="list-style-type: none"> The ATTO Configuration Tool validates the structure of the file. If it does not pass the validation checks, the file is rejected. The image file may be corrupted. Try downloading the image file from http://www.hp.com/support/u320e again.
The SCSI host adapter fails its Power On Self Test.	<ul style="list-style-type: none"> The BIOS driver will perform several checks to verify that the host adapter is functioning. If the BIOS driver determines that the adapter has non-functioning hardware, it will not complete the initialization of the operating system driver. If the BIOS driver determines that the firmware on the adapter is not functioning, it will complete the initialization in degraded mode. Under Windows, degraded mode will not perform I/O but will allow the end user to flash the adapter with working firmware. The POST failure will be recorded in the Windows Event Log. Try to re-flash the firmware using the Configuration Tool. If the problem persists, replace the host adapter.
The software application being used to communicate with the attached SCSI devices reports Parity or communication errors.	<ul style="list-style-type: none"> Check the SCSI cables. There could be slight damage to one conductor causing intermittent failures. Ultra320 SCSI requires high quality cables that are specifically rated for the Ultra320 transmission speeds. Try slowing down the data transmission rate by lowering the sync rate for the drive in question. To do this, launch the ATTO Configuration Tool. Double click on the drive you want to change. The current sync rate will be displayed. Lower it then close and save the changes. Reboot. You can also modify the sync rates by entering the Ctrl-Z SCSI setup program during boot. If this resolves the issue, the SCSI device may need to be replaced.

Linux installation troubleshooting

Table 5 Linux troubleshooting table

Symptoms	Troubleshooting steps
The host adapter driver was loaded properly and everything was working, but the devices do not show up after the computer was rebooted.	<p>On some Red Hat Linux distributions, the driver may not automatically load when the system is booted.</p> <ul style="list-style-type: none"> To enable driver autoload in Red Hat 4, add the following line to <code>/etc/modprobe.conf</code> after installing the driver: <pre>alias scsi_hostadapterX express2 Where X is the next available #.</pre> <p>To enable driver autoload in Red Hat 3, add the following line to <code>/etc/rc.modules</code> after installing the driver:</p> <pre>modprobe express2</pre> <p>(Note: you may need to create <code>/etc/rc.modules</code> and make it executable with <code>chmod +x /etc/rc.modules</code>)</p>
The host adapter can detect the target device at LUN 0 but not the devices at LUN 1 or higher in Red Hat Linux version 3 with kernel 2.4.	<ul style="list-style-type: none"> When using version 2.4 of the Linux kernel e.g. Red Hat 3), devices on LUN 1 or higher may not be detected automatically when the driver is loaded. This is a known issue with the 2.4 kernel. To manually detect such devices, issue the following command: <pre>\$ echo "scsi add-single-device <h> <t> <l>" > /proc/scsi/scsi</pre> <p>Where <code><h></code> is the host, <code></code> is the bus (always 0 for ATTO drivers), <code><t></code> is the target, and <code><l></code> is the LUN. You can confirm that the device has been detected by checking for it in <code>/proc/scsi/scsi</code>.</p>
On certain 64-bit platforms, the driver Makefile may be unable to detect the correct CPU architecture when compiling the driver, an error such as <code>cc1 : error : CPU you selected does not support x86_64 instruction set</code>	<ul style="list-style-type: none"> Specify the correct architecture when running the make command. For example: <code>\$make install ARCH=x86_64</code>
The connected SCSI devices are not detected by the operating system.	<ul style="list-style-type: none"> Verify the driver is loaded by examining the output of the <code>lsmod</code> command for <code>express2</code>. Check <code>/proc/scsi/scsi</code> to see a list of devices that are known by the operating system. This will only list the device at LUN 0 and its negotiated speed.

Symptoms	Troubleshooting steps
The host adapter is recognized, but it does not detect any of the connected SCSI devices.	<p>The command <code>dmesg</code> can be used to see what devices are detected on each SCSI bus.</p> <ul style="list-style-type: none"> Check the SCSI devices and cables (see Investigating the SCSI cables and devices, page 31). Try putting the host adapter in a different PCI slot. Try updating the firmware on the host adapter as described in Updating firmware. If all else fails, replace the SCSI host adapter.
The computer recognizes the host adapter, but only detects connected SCSI devices on one of the busses. The other bus reports no devices.	<p>The command <code>dmesg</code> can be used to see what devices are detected on each SCSI bus.</p> <ul style="list-style-type: none"> Swap the devices and cables from the SCSI bus that appears to be working with the one having issues. If the issue follows the bus, replace the SCSI host adapter. If the issue follows the attached SCSI devices, check the SCSI devices and cables (see Investigating the SCSI cables and devices, page 31).
The host adapter is detected by the operating system, it detects some of the connected devices on both SCSI busses, but does not detect all of the connected devices.	<p>The command <code>dmesg</code> can be used to see what devices are detected on each SCSI bus.</p> <ul style="list-style-type: none"> Check the SCSI devices and cables (see Investigating the SCSI cables and devices, page 31).

Configuration Tool messages

In the Configuration Tool, you might see an error message informing you of an unexpected error or incorrect information discovered by the tool. Using the help text presented with the error message, correct the issue before proceeding.

Warnings and error messages are posted in the **Status** area of the Configuration Tool.

Table 6 Messages from NVRAM tab actions.

Error message	Solution
An error occurred loading NVRAM data.	The first time a channel is highlighted, the tool tries to read NVRAM from the card. This message is displayed if the size of the NVRAM buffer does not match the expected size or the NVRAM buffer could not be retrieved. This message usually indicates that the application could not communicate with the driver, probably because the application does not support the driver version in use.
Warning: NVRAM could not be read, defaults returned.	This message occurs as a result of corrupt NVRAM. When the driver accesses the NVRAM, a continuity check is performed on the NVRAM to ensure the returned data is valid. If this check fails, the driver returns a known NVRAM data buffer that represents card defaults. When this situation occurs, the defaults are presented via the graphical user interface and the user is informed that the values shown are defaults. These defaults must be committed to correct the state of the NVRAM.
An error occurred updating the NVRAM.	The driver cannot put the new settings on the card; no changes are made to the card.
Feature bounds checking	When the Commit button is clicked, each NVRAM feature must be validated before being sent to the card. If any one of these features is deemed inappropriate based on the implementation checks, further NVRAM feature validation checks are stopped and the message is displayed, for example: <i>Execution Throttle is greater than the maximum allowable value of 256. No NVRAM configuration changes have been made to your card.</i> The exact message varies based on the first field with an out-of-range value.

Table 7 Messages from Flash tab actions

Error message	Solution
This is not a flash file, or it is corrupt.	The flash file is corrupt or the Configuration Tool does not recognize the file as a flash file. Only select flash files from the product CD or downloaded from the HP website.
This HBA is not compatible with the selected flash file.	ATTO flash files are created based on the type of card flashed. ATTO flash files are only compatible with certain ATTO cards. When a flash file is selected, the flash file is inspected to determine whether it is compatible.
A valid file was not selected.	You clicked the Cancel button on the flash file selection dialog.
An error occurred reading from the flash file, the file may be corrupt.	You selected a compatible flash file but the contents are corrupt.
An error occurred updating the flash.	You tried to flash a card when the firmware was not able to accept a flash.
The card has been prepared for firmware updating, but the machine must be rebooted for the changes to take effect. You need to repeat this process after rebooting to actually update the firmware.	Some firmware upgrades need to prepare the existing firmware to successfully update the adapter. Rebooting allows the changes made during the preparation process to take effect, and the same file should be flashed again.

Maximizing performance in Windows

If you are experiencing lower performance than expected, there are several things you can do to increase performance, such as making sure you are using the latest driver, setting the registry entry for large block transfers, setting up RAID groups, increasing transfer size, and analyzing your system's I/Os.

While the factory settings on the HP StorageWorks U320e SCSI Host Bus Adapter should provide excellent performance for a wide range of applications, you may improve performance by modifying some of the system factors that affect the adapter. For example, the driver can transfer well over a megabyte with one SCSI command.

Use the latest driver

Determine which driver is currently in use, then install the latest driver found at <http://www.hp.com/support/u320e>.

1. Using the Windows **Device Manager**, select **SCSI & RAID Controllers**.
2. Examine the **Driver** tab for your SCSI adapter. If the driver is not express2.sys, install the express2.sys driver.
3. Either remove the previously-installed driver or disable it using the **Devices** applet. If the system has a built in Symbios or LSI adapter, do not disable the driver for that adapter.

Set registry for large block transfers

If your application requires large block transfers, set the registry entry correctly for the **MaximumSGList** keyword. Several files supplied with the device driver download package can set values in the range 64K to 8M. The files are ASCII text files with .reg extension and can be viewed with any suitable editor. The files also explain the registry setting and how to change the setting.

Increase transfer size

If you are writing to an application that uses a lot of sequential disk I/O to a contiguous area on disk, you should use as large a transfer size as possible to reduce overhead on the system, on the SCSI bus and within disk drives.

Analyze your I/Os

For large sequential data transfers, use *Direct I/O* by selecting *FILE_FLAG_WRITE_THROUGH* and *FILE_FLAG_NO_BUFFERING* flags with your *CreateFile* call to avoid the overhead of copying data from one area of memory to another, to reduce the number of SCSI commands that must be executed, and to leave system pages available for other data.

If your application requires a small number of I/Os and the transfers are rather small, however, you may get better performance by letting the system cache your data in the system pages.

You might want to use overlapped I/O using the *FILE_FLAG_OVERLAPPED* option with the *CreateFile* call. Overlapped I/O allows the application to send many commands to the device at once.

6 Technical specifications

Environmental and physical specifications:

- Operating temperature: 0–45 °C
- Humidity: 10–90% non-condensing
- Airflow: 100 LFM (min.)

Reliability

- MTBF: 150,000 hours
- MTTR: <15 minutes

PCI signal compatibility

- 3.3 Volts/5 Volts universal

Dimensions

- Length: 19.05 cm (7.5 in.)
- Height: 11.115 cm (4.376 in.)

Power

- 1.61 typical/2.03 max. Amps @ 3.3 VDC
- 0.65 typical/1.46 Amps @ +12.0 VDC

Features

- Two external VHDCI connectors
- Supports up to 30 SCSI bus IDs (15 per channel)
- Supports data transfer speeds of up to 320 MB/sec per channel
- PCI Express (PCIe) bus management
 - PCI Bus master rate 2 GM/sec
 - PCI-Express 1.0b compliant
- Supports Ultra320 specifications including:
 - Packetized SCSI
 - Double Transition Clocking
 - Quick Arbitration Select (QAS)
 - Cyclical Redundancy Check (CRC)
 - Domain Validation
 - Asynchronous Information Protection (AIP)
 - Free-Running Clock
 - Flow Control
- Advanced Data Streaming (ADS™ provides controlled acceleration of data transfers.
 - Embedded RISC processor for low overhead
 - Bus mastering eliminates CPU processing time as a bottleneck
 - Tagged command queuing allows threads to be processed efficiently
 - Disconnect/reconnect eliminates wait time between transfers
 - Optimized scatter/gather lists
- Backward compatible with legacy SCSI devices
- ASPI (Windows®) compatible
- Automatic and upper-byte termination
- Flash ROM for easy field upgrades

A Regulatory compliance and safety

Regulatory compliance

Regulatory compliance identification numbers

For the purpose of regulatory compliance certifications and identification, your product has been assigned a unique Regulatory Model Number. The RMN can be found on the product nameplate label, along with all required approval markings and information. When requesting compliance information for this product, always refer to this RMN. The Regulatory Model Number should not be confused with the marketing name or model number of the product.

Regulatory compliance label location

The BSMI and UCCI labels are located on the non-static bag containing the adapter.

Regulatory model number

FCLSE-0644

Emissions classification

Class A

Federal Communications Commission notice

Part 15 of the Federal Communications Commission (FCC) Rules and Regulations has established Radio Frequency (RF) emission limits to provide an interference-free radio frequency spectrum. Many electronic devices, including computers, generate RF energy incidental to their intended function and are, therefore, covered by these rules. These rules place computers and related peripheral devices into two classes, A and B, depending upon their intended installation. Class A devices are those that may reasonably be expected to be installed in a business or commercial environment. Class B devices are those that may reasonably be expected to be installed in a residential environment (such as personal computers). The FCC requires devices in both classes to bear a label indicating the interference potential of the device as well as additional operating instructions for the user.

The rating label on the device shows which class (A or B) the equipment falls into. Class B devices have an FCC logo or FCC ID on the label. Class A devices do not have an FCC logo or FCC ID on the label. Once the class of the device is determined, refer to the following corresponding statement.

Class A equipment

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user is required to correct the interference at personal expense.

Class B equipment

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit that is different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or television technician for help.

Declaration of conformity for products marked with the FCC logo, United States only

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions regarding your product, visit <http://www.hp.com>

For questions regarding this FCC declaration, contact us by mail or telephone:

- Hewlett-Packard Company P.O. Box 692000, Mailstop 510101 Houston, Texas 77269-2000
- 1-281-514-3333

To identify this product, refer to the part, Regulatory Model Number, or product number found on the product.

Modifications

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Hewlett-Packard Company may void the user's authority to operate the equipment.

Cables

Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations.

Laser device

All HP systems equipped with a laser device comply with safety standards, including International Electrotechnical Commission (IEC) 825. With specific regard to the laser, the equipment complies with laser product performance standards set by government agencies as a Class 1 laser product. The product does not emit hazardous light.

Laser safety warning

⚠️ WARNING!

To reduce the risk of exposure to hazardous radiation:

- Do not try to open the laser device enclosure. There are no user-serviceable components inside.
- Do not operate controls, make adjustments, or perform procedures to the laser device other than those specified herein.
- Allow only HP authorized service technicians to repair the laser device.

International notices and statements

Canadian notice (avis Canadien)

Class A equipment

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Class B equipment

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Union regulatory notice

This product complies with the following EU Directives:

- Low Voltage Directive 73/23/EEC — EN60950
- EMC Directive 89/336/EEC — EN55022 and EN55024

Compliance with these directives implies conformity to applicable harmonized European standards (European Norms) which are listed on the EU Declaration of Conformity issued by Hewlett-Packard for this product or product family.

BSMI notice

警告使用者：

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Japanese notice

ご使用になっている装置にVCCIマークが付いていましたら、次の説明文をお読み下さい。

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取扱説明書に従って正しい取り扱いをして下さい。

VCCIマークが付いていない場合には、次の点にご注意下さい。

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

Korean notices

A급 기기 (업무용 정보통신기기)

이 기기는 업무용으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며, 만약 잘못판매 또는 구입하였을 때에는 가정용으로 교환하시기 바랍니다.

B급 기기 (가정용 정보통신기기)

이 기기는 가정용으로 전자파적합등록을 한 기기로서 주거지역에서는 물론 모든지역에서 사용할 수 있습니다.

Safety

Taiwan battery recycling notice



The Taiwan EPA requires dry battery manufacturing or importing firms in accordance with Article 15 of the Waste Disposal Act to indicate the recovery marks on the batteries used in sales, giveaway or promotion. Contact a qualified Taiwanese recycler for proper battery disposal.

Power cords

The power cord set must meet the requirements for use in the country where the product was purchased. If the product is to be used in another country, purchase a power cord that is approved for use in that country.

The power cord must be rated for the product and for the voltage and current marked on the product electrical ratings label. The voltage and current rating of the cord should be greater than the voltage

and current rating marked on the product. In addition, the diameter of the wire must be a minimum of 1.00 mm² or 18 AWG, and the length of the cord must be between 1.8 m (6 ft) and 3.6 m (12 ft). If you have questions about the type of power cord to use, contact an HP authorized service provider.

 **NOTE:**

Route power cords so that they will not be walked on and cannot be pinched by items placed upon or against them. Pay particular attention to the plug, electrical outlet, and the point where the cords exit from the product.

Japanese power cord notice

製品には、同梱された電源コードをお使い下さい。
同梱された電源コードは、他の製品では使用出来ません。

Waste electrical and electronic equipment directive

Czechoslovakian notice

Likvidace zařízení soukromými domácími uživateli v Evropské unii



Tento symbol na produktu nebo balení označuje výrobek, který nesmí být vyhozen spolu s ostatním domácím odpadem. Povinností uživatele je předat takto označený odpad na předem určené sběrné místo pro recyklaci elektrických a elektronických zařízení. Okamžité třídění a recyklace odpadu pomůže uchovat přírodní prostředí a zajistí takový způsob recyklace, který ochrání zdraví a životní prostředí člověka.

Další informace o možnostech odevzdání odpadu k recyklaci získáte na příslušném obecním nebo městském úřadě, od firmy zabývající se sběrem a svozem odpadu nebo v obchodě, kde jste produkt zakoupili.

Danish notice

Bortskaffelse af affald fra husstande i den Europæiske Union



Hvis produktet eller dets emballage er forsynet med dette symbol, angiver det, at produktet ikke må bortskaffes med andet almindeligt husholdningsaffald. I stedet er det dit ansvar at bortskaffe kasseret udstyr ved at aflevere det på den kommunale genbrugsstation, der forestår genvinding af kasseret elektrisk og elektronisk udstyr. Den centrale modtagelse og genvinding af kasseret udstyr i forbindelse med bortskaffelsen bidrager til bevarelse af naturlige ressourcer og sikrer, at udstyret genvindes på en måde, der beskytter både mennesker og miljø. Yderligere oplysninger om, hvor du kan aflevere kasseret udstyr til genvinding, kan du få hos kommunen, den lokale genbrugsstation eller i den butik, hvor du købte produktet.

Dutch notice

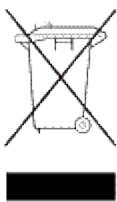
Verwijdering van afgedankte apparatuur door privé-gebruikers in de Europese Unie



Dit symbool op het product of de verpakking geeft aan dat dit product niet mag worden gedeponeerd bij het normale huishoudelijke afval. U bent zelf verantwoordelijk voor het inleveren van uw afgedankte apparatuur bij een inzamelingspunt voor het recyclen van oude elektrische en elektronische apparatuur. Door uw oude apparatuur apart aan te bieden en te recycelen, kunnen natuurlijke bronnen worden behouden en kan het materiaal worden hergebruikt op een manier waarmee de volksgezondheid en het milieu worden beschermd. Neem contact op met uw gemeente, het afvalinzamelingsbedrijf of de winkel waar u het product hebt gekocht voor meer informatie over inzamelingspunten waar u oude apparatuur kunt aanbieden voor recycling.

English notice

Disposal of waste equipment by users in private household in the European Union



This symbol on the product or on its packaging indicates that this product must not be disposed of with your other household waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service, or the shop where you purchased the product.

Estonian notice

Seadmete jäätmete kõrvaldamine eramajapidamistes Euroopa Liidus



See tootel või selle pakendil olev sümbol näitab, et kõnealust toodet ei tohi koos teiste majapidamisjäätmega kõrvaldada. Teie kohus on oma seadmete jäätmed kõrvaldada, viies need elektri- ja elektroonikaseadmete jäätmete ringlussevõtmiseks selleks ettenähtud kogumispunkti. Seadmete jäätmete eraldi kogumine ja ringlussevõtmine kõrvaldamise ajal aitab kaitsta loodusvarasid ning tagada, et ringlussevõtmine toimub viisil, mis kaitseb inimeste tervist ning keskkonda. Lisateabe saamiseks selle kohta, kuhu oma seadmete jäätmed ringlussevõtmiseks viia, võtke palun ühendust oma kohaliku linnakantselei, majapidamisjäätmete kõrvaldamise teenistuse või kauplusega, kust Te toote ostsite.

Finnish notice

Laitteiden hävittäminen kotitalouksissa Euroopan unionin alueella



Jos tuotteessa tai sen pakkauksessa on tämä merkki, tuotetta ei saa hävittää kotitalousjätteiden mukana. Tällöin hävitettävä laite on toimitettava sähkölaitteiden ja elektronisten laitteiden kierrätyspisteesseen. Hävitettävien laitteiden erillinen käsittely ja kierrätys auttavat säestämään luonnonvaroja ja varmistamaan, että laite kierrätetään tavalla, joka estää terveyshaitat ja suojelee luontoa. Lisätietoa paikoista, joihin hävitettävät laitteet voi toimittaa kierrätettäväksi, saa ottamalla yhteyttä jätehuoltoon tai liikkeeseen, josta tuote on ostettu.

French notice

Élimination des appareils mis au rebut par les ménages dans l'Union européenne



Le symbole apposé sur ce produit ou sur son emballage indique que ce produit ne doit pas être jeté avec les déchets ménagers ordinaires. Il est de votre responsabilité de mettre au rebut vos appareils en les déposant dans les centres de collecte publique désignés pour le recyclage des équipements électriques et électroniques. La collecte et le recyclage de vos appareils mis au rebut indépendamment du reste des déchets contribue à la préservation des ressources naturelles et garantit que ces appareils seront recyclés dans le respect de la santé humaine et de l'environnement. Pour obtenir plus d'informations sur les centres de collecte et de recyclage des appareils mis au rebut, veuillez contacter les autorités locales de votre région, les services de collecte des ordures ménagères ou le magasin dans lequel vous avez acheté ce produit.

German notice

Entsorgung von Altgeräten aus privaten Haushalten in der EU



Das Symbol auf dem Produkt oder seiner Verpackung weist darauf hin, dass das Produkt nicht über den normalen Hausmüll entsorgt werden darf. Benutzer sind verpflichtet, die Altgeräte an einer Rücknahmestelle für Elektro- und Elektronik-Altgeräte abzugeben. Die getrennte Sammlung und ordnungsgemäße Entsorgung Ihrer Altgeräte trägt zur Erhaltung der natürlichen Ressourcen bei und garantiert eine Wiederverwertung, die die Gesundheit des Menschen und die Umwelt schützt. Informationen dazu, wo Sie Rücknahmestellen für Ihre Altgeräte finden, erhalten Sie bei Ihrer Stadtverwaltung, den örtlichen Müllentsorgungsbetrieben oder im Geschäft, in dem Sie das Gerät erworben haben.

Greek notice

Απόρριψη άχρηστου εξοπλισμού από χρήστες σε ιδιωτικά νοικοκυριά στην Ευρωπαϊκή Ένωση



Το σύμβολο αυτό στο προϊόν ή τη συσκευασία του υποδεικνύει ότι το συγκεκριμένο προϊόν δεν πρέπει να διατίθεται μαζί με τα άλλα οικιακά σας απορρίμματα. Αντίθετα, είναι δική σας ευθύνη να απορρίψετε τον άχρηστο εξοπλισμό σας παραδίδοντάς τον σε καθορισμένο σημείο συλλογής για την ανακύκλωση άχρηστου ηλεκτρικού και ηλεκτρονικού εξοπλισμού.

Η ξεχωριστή συλλογή και ανακύκλωση του άχρηστου εξοπλισμού σας κατά την απόρριψη θα συμβάλει στη διατήρηση των φυσικών πόρων και θα διασφαλίσει ότι η ανακύκλωση γίνεται με τρόπο που προστατεύει την ανθρώπινη υγεία και το περιβάλλον. Για περισσότερες πληροφορίες σχετικά με το πού μπορείτε να παραδώσετε τον άχρηστο εξοπλισμό σας για ανακύκλωση, επικοινωνήστε με το αρμόδιο τοπικό γραφείο, την τοπική υπηρεσία διάθεσης οικιακών απορριμμάτων ή το κατάστημα όπου αγοράσατε το προϊόν.

Hungarian notice

Készülékek magánháztartásban történő selejtezése az Európai Unió területén



A készüléken, illetve a készülék csomagolásán látható azonos szimbólum annak jelzésére szolgál, hogy a készülék a selejtezés során az egyéb háztartási hulladéktól eltérő módon kezelendő. A vásárló a hulladékká vált készüléket köteles a kijelölt gyűjtőhelyre szállítani az elektromos és elektronikai készülékek újrahasznosítása céljából. A hulladékká vált készülékek selejtezéskori begyűjtése és újrahasznosítása hozzájárul a természeti erőforrások megőrzéséhez, valamint biztosítja a selejtezett termékek környezetre és emberi egészségre nézve biztonságos feldolgozását. A begyűjtés pontos helyéről bővebb tájékoztatást a lakhelye szerint illetékes önkormányzattól, az illetékes szemétteltakarító vállalattól, illetve a terméket elárusító helyen kaphat.

Italian notice

Smaltimento delle apparecchiature da parte di privati nel territorio dell'Unione Europea



Questo simbolo presente sul prodotto o sulla sua confezione indica che il prodotto non può essere smaltito insieme ai rifiuti domestici. È responsabilità dell'utente smaltire le apparecchiature consegnandole presso un punto di raccolta designato al riciclo e allo smaltimento di apparecchiature elettriche ed elettroniche. La raccolta differenziata e il corretto riciclo delle apparecchiature da smaltire permette di proteggere la salute degli individui e l'ecosistema. Per ulteriori informazioni relative ai punti di raccolta delle apparecchiature, contattare l'ente locale per lo smaltimento dei rifiuti, oppure il negozio presso il quale è stato acquistato il prodotto.

Latvian notice

Nolietotu iekārtu iznīcināšanas noteikumi lietotājiem Eiropas Savienības privātajās mājsaimniecībās



Šāds simbols uz izstrādājuma vai uz tā iesaiņojuma norāda, ka šo izstrādājumu nedrīkst izmest kopā ar citiem sadzīves atkritumiem. Jūs atbildat par to, lai nolietotās iekārtas tiku nodotas speciāli iekārtotos punktos, kas paredzēti izmantoto elektrisko un elektronisko iekārtu savākšanai otrreizējai pārstrādei. Atsevišķa nolietoto iekārtu savākšana un otrreizējā pārstrāde paīdzēs saglabāt dabas resursus un garantēs, ka šīs iekārtas tiks otrreizēji pārstrādātas tādā veidā, lai pasargātu vidi un cilvēku veselību. Lai uzzinātu, kur nolietotās iekārtas var izmest otrreizējai pārstrādei, jāvēršas savas dzīves vietas pašvaldībā, sadzīves atkritumu savākšanas dienestā vai veikalā, kurā izstrādājums tika nopirkts.

Lihuanian notice

Nolietotu iekārtu iznīcināšanas noteikumi lietotājiem Eiropas Savienības privātajās mājsaimniecībās



Šāds simbols uz izstrādājuma vai uz tā iesaiņojuma norāda, ka šo izstrādājumu nedrīkst izmest kopā ar citiem sadzīves atkritumiem. Jūs atbildat par to, lai nolietotās iekārtas tiktu nodotas speciāli iekārtotos punktos, kas paredzēti izmantoto elektrisko un elektronisko iekārtu savākšanai otrreizējai pārstrādei. Atsevišķa nolietoto iekārtu savākšana un otrreizējā pārstrāde palīdzēs saglabāt dabas resursus un garantēs, ka šīs iekārtas tiks otrreizēji pārstrādātas tādā veidā, lai pasargātu vidi un cilvēku veselību. Lai uzzinātu, kur nolietotās iekārtas var izmest otrreizējai pārstrādei, jāvēršas savas dzīves vietas pašvaldībā, sadzīves atkritumu savākšanas dienestā vai veikalā, kurā izstrādājums tika nopirkts.

Polish notice

Pozbywanie się zużytego sprzętu przez użytkowników w prywatnych gospodarstwach domowych w Unii Europejskiej



Ten symbol na produkcie lub jego opakowaniu oznacza, że produktu nie wolno wyrzucać do zwykłych pojemników na śmieci. Obowiązkiem użytkownika jest przekazanie zużytego sprzętu do wyznaczonego punktu zbiórki w celu recyklingu odpadów powstałych ze sprzętu elektrycznego i elekonicznego. Osobna zbiórka oraz recykling zużytego sprzętu pomogą w ochronie zasobów naturalnych i zapewnią ponowne wprowadzenie go do obiegu w sposób chroniący zdrowie człowieka i środowisko. Aby uzyskać więcej informacji o tym, gdzie można przekazać zużyty sprzęt do recyklingu, należy się skontaktować z urzędem miasta, zakładem gospodarki odpadami lub sklepem, w którym zakupiono produkt.

Portuguese notice

Descarte de Lixo Elétrico na Comunidade Européia



Este símbolo encontrado no produto ou na embalagem indica que o produto não deve ser descartado no lixo doméstico comum. É responsabilidade do cliente descartar o material usado (lixo elétrico), encaminhando-o para um ponto de coleta para reciclagem. A coleta e a reciclagem seletivas desse tipo de lixo ajudarão a conservar as reservas naturais; sendo assim, a reciclagem será feita de uma forma segura, protegendo o ambiente e a saúde das pessoas. Para obter mais informações sobre locais que reciclam esse tipo de material, entre em contato com o escritório da HP em sua cidade, com o serviço de coleta de lixo ou com a loja em que o produto foi adquirido.

Slovakian notice

Likvidácia vyradených zariadení v domácnostiach v Európskej únii



Symbol na výrobku alebo jeho balení označuje, že daný výrobok sa nesmie likvidovať s domovým odpadom. Povinnosťou spotrebiteľa je odovzdať vyradené zariadenie v zbernom mieste, ktoré je určené na recykláciu vyradených elektrických a elektronických zariadení. Separovaný zber a recyklácia vyradených zariadení prispieva k ochrane prírodných zdrojov a zabezpečuje, že recyklácia sa vykonáva spôsobom chrániacim ľudské zdravie a životné prostredie. Informácie o zberných miestach na recykláciu vyradených zariadení vám poskytne miestne zastupiteľstvo, spoločnosť zabezpečujúca odvoz domového odpadu alebo obchod, v ktorom ste si výrobok zakúpili.

Slovenian notice

Odstranjevanje odslužene opreme uporabnikov v zasebnih gospodinjstvih v Evropski uniji



Ta znak na izdelku ali njegovi embalaži pomeni, da izdelka ne smete odvreči med gospodinjske odpadke. Nasprotno, odsluženo opremo morate predati na zbirališče, pooblaščeno za recikliranje odslužene električne in elektronske opreme. Ločeno zbiranje in recikliranje odslužene opreme prispeva k ohranjanju naravnih virov in zagotavlja recikliranje te opreme na zdravju in okolju neškodljiv način. Za podrobnejše informacije o tem, kam lahko odpeljete odsluženo opremo na recikliranje, se obrnite na pristojni organ, komunalno službo ali trgovino, kjer ste izdelek kupili.

Spanish notice

Eliminación de residuos de equipos eléctricos y electrónicos por parte de usuarios particulares en la Unión Europea



Este símbolo en el producto o en su envase indica que no debe eliminarse junto con los desperdicios generales de la casa. Es responsabilidad del usuario eliminar los residuos de este tipo depositándolos en un "punto limpio" para el reciclado de residuos eléctricos y electrónicos. La recogida y el reciclado selectivos de los residuos de aparatos eléctricos en el momento de su eliminación contribuirá a conservar los recursos naturales y a garantizar el reciclado de estos residuos de forma que se proteja el medio ambiente y la salud. Para obtener más información sobre los puntos de recogida de residuos eléctricos y electrónicos para reciclado, póngase en contacto con su ayuntamiento, con el servicio de eliminación de residuos domésticos o con el establecimiento en el que adquirió el producto.

Swedish notice

Bortskaffande av avfallsprodukter från användare i privathushåll inom Europeiska Unionen



Om den här symbolen visas på produkten eller förpackningen betyder det att produkten inte får slängas på samma ställe som hushållssopor. I stället är det ditt ansvar att bortskaffa avfallet genom att överlämna det till ett uppsamlingsställe avsett för återvinning av avfall från elektriska och elektroniska produkter. Separat insamling och återvinning av avfallet hjälper till att spara på våra naturresurser och gör att avfallet återvinnas på ett sätt som skyddar människors hälsa och miljön. Kontakta ditt lokala kommunkontor, din närmsta återvinningsstation för hushållsavfall eller affären där du köpte produkten för att få mer information om var du kan lämna ditt avfall för återvinning.

B Electrostatic discharge

To prevent damaging the system, be aware of the precautions you need to follow when setting up the system or handling parts. A discharge of static electricity from a finger or other conductor may damage system boards or other static-sensitive devices. This type of damage may reduce the life expectancy of the device.

Topics include:

- Preventing electrostatic damage
- Grounding methods

Preventing electrostatic damage

To prevent electrostatic damage, observe the following precautions:

- Avoid hand contact by transporting and storing products in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free workstations.
- Place parts on a grounded surface before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Always be properly grounded when touching a static-sensitive component or assembly. See the next section.

Grounding methods

There are several methods for grounding. Use one or more of the following methods when handling or installing electrostatic-sensitive parts:

- Use a wrist strap connected by a ground cord to a grounded workstation or computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm (± 10 percent) resistance in the ground cords. To provide proper ground, wear the strap snug against the skin.
- Use heel straps, toe straps, or boot straps at standing workstations. Wear the straps on both feet when standing on conductive floors or dissipating floor mats.
- Use conductive field service tools.
- Use a portable field service kit with a folding static-dissipating work mat.

If you do not have any of the suggested equipment for proper grounding, have an HP authorized reseller install the part.



NOTE:

For more information on static electricity, or assistance with product installation, contact your HP authorized reseller.

Glossary

ANSI	American National Standards Institute
arbitrate	Process of selecting one L_Port from a collection of ports which ask for use of the arbitrated loop at the same time.
Asynchronous Information Protection	AIP: although most Ultra320 traffic is sent synchronously and protected by CRC, some information is still sent asynchronously. AIP implements CRC-level error checking on asynchronous traffic ensuring end-to-end data integrity.
autonegotiation	hardware senses and automatically responds depending on configuration
BER	Bit Error Rate. A measure of transmission accuracy; the ratio of bits received in error to bits sent.
bit	Smallest unit of data a computer can process: a single binary digit with a value of either 0 or 1.
bus	a collection of unbroken signal lines used to transmit information from one part of a computer system to another. Taps on the lines connect devices to the bus.
byte	an ordered set of 8 bits
channel	a point-to-point link which transports data from one point to another.
CPU	Central Processing Unit. The portion of the computer that performs computations.
CRC	Cyclic Redundancy Checking, an error-correcting code which calculates a numeric value for received and transmitted data. If no error has occurred during transmission, the CRC for both received and transmitted data should be the same.
destination address	A value in the frame header of each frame which identifies the port in the node where the frame is being sent
device driver	A program that allows a microprocessor to direct the operation of a peripheral device.
DMA	Direct Memory Access. A way to move data from a storage device directly to RAM without using the CPU's resources.
DMA bus master	Allows a peripheral to control the flow of data to and from system memory by block as opposed to allowing the processor to control the data by bytes (PIO or programmed I/O).
domain validation	Before sending data, domain validation verifies that the physical connection is capable of handling the negotiated transfer speed. If the system determines that Ultra320 speeds are not feasible, a slower speed is enforced.
double transition clocking	Increases the data line frequency to equal that of the request signal, allowing sampling on both the leading and trailing edges of the request signal. Clocking can be set to ensure compatibility with legacy devices.
flow control	The target indicates to the initiator when the last packet of a data stream will be transferred so that the initiator can flush FIFOs and terminate pre-fetch sooner than previously possible. Basically, the target warns the initiator that the transfer

	is almost complete so that it can prepare for the next transfer while the target completes the current transfer.
full duplex	A communication protocol which allows transmission in both directions at the same time.
half duplex	A communication protocol which allows transmission in both directions, but only one direction at a time.
host	A processor, usually a CPU and memory, which communicates with devices over an interface.
HVD	High voltage differential: uses two wires, transmitting a signal on one and its inverse on the other. At the receiving end, the difference between the two signals is measured and interpreted. Noise on the bus will affect both the signal and its inverse equally, so the difference between the two lines will remain the same and the noise cannot be misread as a signal.
initiator device	A component which originates a command
LED	Light-emitting diode: a type of diode that emits light when current passes through it. Visible LEDs are used as indicator lights on many electronic devices.
LUN	Logical Unit Number. An address for a component of a SCSI device, similar to an apartment number. In a library, for example, the host computer might send the SCSI commands for the library to LUN1 of the tape drive and send SCSI commands for the tape drive itself to LUN 0.
LVD	Low voltage differential. SCSI signalling method that combines the benefits of HVD and single-ended technologies, allowing longer cabling configurations while consuming less power than HVD technology.
originator	An initiating device; a component which originates a command
packetization	Creates information units (IUs) from commands, data, status information, etc. which are passed as synchronous transfers. Maximizes bus use, minimizes command overhead and allows multiple commands to be transferred in a single connection
parity checking	A method that verifies the accuracy of data transmitted over the SCSI bus by adding one bit in the transfer to make the sum of all the bits either odd or even (for odd or even parity). An error message occurs if the sum is not correct.
PCI	Peripheral Component Interconnect. Allows peripherals to be connected directly to computer memory, bypassing the slower ISA and EISA busses.
point-to-point	A topology where two ports communicate.
port	An access point in a device.
port address	The address, assigned by the PCI bus, through which commands are sent to a host adapter board. Also called port number.
pre-compensation	Although SCSI transfer speeds have changed dramatically over the past several generations, cable specifications have remained constant. Higher speed and frequency signals have a greater potential for reflection and distortion over distance. Pre-compensation techniques slightly modify the SCSI signal to reduce the chance of these types of problems.
Quick Arbitration Select (QAS) Arbitration	The process of devices negotiating for control of the bus with built-in "quiet times" so that fast and legacy devices have an opportunity to take control of the bus. A fair, but somewhat inefficient process, QAS speeds up the arbitration

	process by eliminating the bus free phase. When combined with packetization, reduces command overhead and maximizes bus use.
read and write data streaming	Minimizes data transfer overhead by allowing a target to send one data stream (LQ) packet followed by multiple data packets. Minimizes overhead of data transfers because the target can send one data stream packet followed by multiple data packets.
receiver	The ultimate destination of data transmission; a terminal device
SCSI	Small Computer Systems Interface: a processor-independent standard for system-level interface between a computer and intelligent devices including hard disks, floppy disks, CD-ROM, printers, scanners, etc.
single-ended	An electrical signal protocol that transmits information through changes in voltage. Single-ended SCSI uses standard TTL signal and ground pairs to transmit information over the SCSI bus.
topology	Logical layout of the parts of a computer system or network and their interconnections.
training pattern	SCSI is a parallel bus technology that is dependent on signals being transmitted on parallel wires simultaneously. At higher speeds, minute differences in wire lengths and transmission characteristics could cause problems. Training pattern testing measures these minute differences and compensates for them.
transceiver	A transmitter/receiver module.
transfer rate	The rate at which bytes or bits are transferred, as in megabytes or gigabits per second.

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